

# THE DECOLORIZATION OF THE LITTLE RIVER WATER SUPPLY IN CONNECTION WITH FILTRATION AT SPRINGFIELD, MASS.

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Sulphate of alumina as a coagulant and decolorizer is in use on many waters in the United States, and is recognized as one of the most effectual means of reducing an objectionable color in the water prior to filtration. The river water as applied to the West Parish filters of the Springfield water supply is naturally a water of few objectionable features. No large population is resident upon the water-shed and the sanitary conditions are excellent so that there is not a large danger of serious contamination of the supply at any time.

By filtration a water free from practically all objections is produced, except that at times, the remaining color is noticeable, and the present system of coagulation is the result of a study of the means of correcting this one objection to the water.

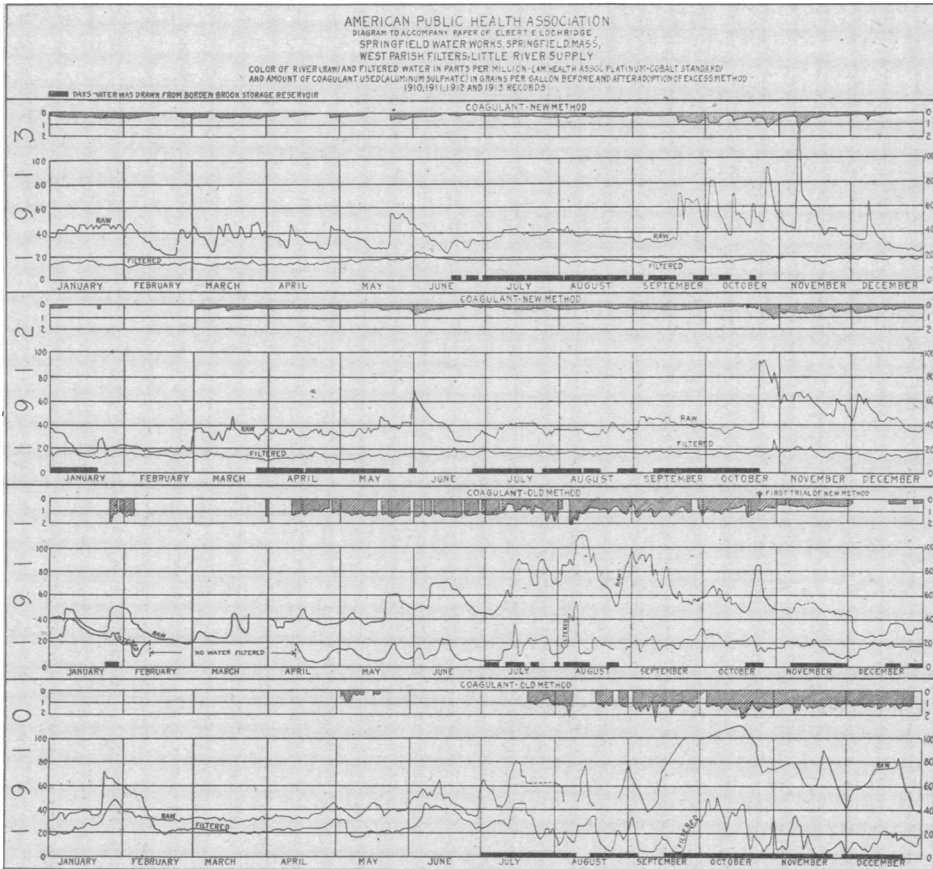
This water was first used as a supply in December, 1909, and sulphate of alumina was used for the reduction of color in the manner in which it is usually applied. The accompanying cut showing the use of coagulant during 1910 illustrates the amount of sulphate of alumina which was necessary for this reduction. Its application during this year was in accordance with the usual practice, that is, in amounts sufficient to secure a clear-cut reaction and the coagulant was applied continuously. The present method is illustrated by the chart showing the amounts and the color of the raw and filtered water during 1912 and 1913.

As at present practised, excellent color reduction is secured by the use of 0.2 grain of sulphate of alumina per gallon of water during a larger portion of the time.

## METHOD OF APPLICATION AND DETERMINATION OF AMOUNT NECESSARY.

It has long been recognized that better results are secured from the sulphate of alumina in an acid water, and this fact may have some bearing on the results obtained. From ten to twenty samples of water are taken in two-gallon bottles and placed in a row on the laboratory table. To these are added varying amounts of sulphate of alumina from a standard solution, so that the effect of each amount is determined, both as to its final effect and as to the length of time necessary for reaction. For example, to the first bottle an amount which would be equal to one grain per gallon is added, to the second 1.1, to the third 1.2, etc., up to perhaps 2.0

or even 2.5 grains per gallon. In this manner for the water of that day the amount of coagulant is determined which will quickly throw down substantially all of the color with a good precipitate in a very short time. If, for example, this reaction is found to be 1.7 grains of sulphate of alumina per gallon, the feed apparatus for coagulant for the main supply is set for a feed of say 1.9 grains of sulphate of alumina per gallon. This amount



thus applied is always in excess of the amount necessary for the complete reaction and is also an amount which exceeds the available alkalinity of the water, so that in the prompt reaction obtained all of the alkalinity is used up and an excess of sulphate of alumina is applied to the water.

The application of this coagulant is made in a concrete conduit which delivers the water from the river into a settling basin having a capacity of about 40 million gallons, which is a little over three days' supply.

This rate of coagulation is continued for a period of from four to six hours

and then the coagulant is shut off entirely and the river water allowed to flow in its natural state into this same basin uninterruptedly.

The effect of this intermittent feed applied from 15 to 30 per cent. of the total time is twofold. In the first place the amount of water coagulated with a color substantially 0 is added to this large basin, and the effect of mixing of water of a color of 0 with water with a color of 40 represents one of the factors in the decolorization of the water. On account of the excess amount applied, a mass reaction has taken place and all of the alkalinity and coloring matter has been combined with the coagulant. A second reaction becomes effective at the outlet of the conduit where the water is thrown into contact with the remaining and uncoagulated water and this reaction has the further effect of neutralizing all of the sulphate of alumina not as yet precipitated. There is also another effect which has been recognized in some places in the application of a hydrate of alumina to water, in the effect which the flocs thus introduced but not precipitated at that point will have in the improvement of the water. These conditions produce when properly applied, a uniformly good water of satisfactory color, with a total expenditure for coagulant of not over 25 per cent. of the amount required if the coagulant is applied continuously.

Further information was obtained by applying the same amount of coagulant throughout the twenty-four hours or even twelve hours without any effect on the reduction of color whatever; so that it will be seen that it is necessary to get the clear-cut reaction which is noted above in the water actually treated.

The determinations outlined are made daily or at frequent intervals when little change is to be noted in the character of the raw water, but are absolutely necessary for the determination of the right amount to be applied if the stream is rising or falling, or changing in its nature as such streams do from day to day. It can also be seen that the alkalinity of the water plays but a minor part in this reaction, inasmuch as the hardness must be entirely utilized or combined only during the period of application; and it has been found by experiment that the changes in alkalinity have not been as important as have the source of supply. Different amounts were needed for the treatment of the water following rains where high level swamps have overflowed into the stream, from that necessary when water is drawn from the storage reservoir, and different amounts have been needed for water from the storage reservoir when drawn from different levels or at different seasons.

This method of treatment has an additional advantage in the removal of the necessity of adding soda ash or other chemicals for the hardening of the water, inasmuch as in the full reaction but a part of the alkalinity even of a very soft water is used.

Mr. Herbert F. Salmonde has been the chemist in charge of this work, and it is under his direction that the reactions have been determined on the Springfield water.